WHAT IS CLAIMED IS:

1. A hydrogen storage material comprising metal nanoparticles that are a) a mixture of nanometer scale platelets and nanometer scale equiaxial particles and/or b) a metal core covered by a metal shell or metal coating.

2. The hydrogen storage material of claim 1, wherein the metal nanoparticles are a mixture of nanometer scale platelets and nanometer scale equiaxial particles.

3. The hydrogen storage material of claim 1, wherein the nanoparticles form a metal core covered by a metal shell or metal coating that provides oxidation resistance to the metal core, which is less noble than the coating.

4. The hydrogen storage material of claim 1, wherein the nanoparticles form a metal core covered by a metal shell or metal coating that provides catalysis for dehydrogenation.

5. The hydrogen storage material of claim 1, wherein the nanoparticles form a metal core covered by a) a first metal coating that provides oxidation resistance to the core metal, which is less noble than the coating, and b) a second metal coating that provides catalysis for dehydrogenation.

6. The hydrogen storage material of claim 1, wherein said metal nanoparticles are selected from Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Li, Mg, Ca, Na, K, Pd, Pt, Au, or Ag, or an alloy containing one or more of these metals.

7. The hydrogen storage material of claim 3, wherein said shell or coating

is selected from Cr, Mn, Fe, Co, Ni, Cu, Pd, Pt, Au, or an alloy containing one or more of these metals.

8. The hydrogen storage material of claim 2, wherein said platelets have a thickness of about 1 nm to about 200 nm and a face dimension of about 10 nm to about 1000 nm.

9. The hydrogen storage material of claim 8, wherein an aspect ratio (face diameter divided by thickness) of the platelets ranges from about 10 nm to about 100 nm.

10. The hydrogen storage material of claim 9, wherein said platelets are Pd platelets.

11. The hydrogen storage material of claim 1, wherein the nanoparticles form a metal core covered by a first coating that provides oxidation resistance to the core metal, which is less noble than the coating, and/or a second coating that provides catalysis for dehydrogenation

12. The hydrogen storage material of claim 2, wherein said metal is selected from Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Li, Mg, Ca, Na, K, Pd, Pt, Au, or Ag, or an alloy containing one or more of these metals.

13. The hydrogen storage material of claim 11, wherein said first and/or second coating is selected from Cr, Mn, Fe, Co, Ni, Cu, Pd, Pt, Au, or an alloy containing one or more of these metals.

14. A method of preparing the hydrogen storage material, comprising:

a) mixing octylamine and an aqueous solution containing palladium nitrate;

b) adding hydrazine hydrate as a reducing agent thus forming a mixture of metal nanoparticles comprising platelets and equiaxial particles;

c) separating and recovering the platelets and equiaxial particles.

15. The method of claim 14, wherein in step a), about 1 part molar amylamine is also mixed with the octylamine, which is present in about 25 parts molar.

16. A hydrogen storage material comprising nanoparticles with each nanoparticle comprising

a) a core comprising a metal selected from the group consisting of Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Li, Mg, Ca, Na, K, Pd, Pt, Au, Ag and an alloy containing one or more of these metals;

b) a shell comprising a metal selected from the group consisting of Cr, Mn, Fe, Co, Ni, Cu, Pd, Pt or Au and an alloy containing one or more of these metals;

wherein the metal or alloy of the core is different from the metal or alloy of the shell.

17. The hydrogen storage material of claim 16 wherein the core material is Mg.

18. The hydrogen storage material of claim 16 wherein the shell is an alloy containing a polymeric material.

19. A hydrogen storage material, comprising:

a) a mixture of nanometer scale platelets and nanometer scale equiaxed particles that each comprise cores comprising a metal selected from the group consisting of Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Li, Mg, Ca, Na, K, Pd, Pt, Au, Ag and an alloy containing one or more of these metals,

b) a shell over the cores, said shell comprising a metal that is more noble than a less noble metal of the core and that is selected from the group consisting of Cr, Mn, Fe, Co, Ni, Cu, Pd, Pt or Au and an alloy containing one or more of these metals, wherein said shell is capable of providing catalysis for dehydrogenation and/or capable of providing oxidation resistance to the less noble core metal.

20. The hydrogen storage material of claim 21 wherein the cores are Mg or an alloy containing Mg.

21. The hydrogen storage material of claim 22 wherein said platelets comprise nanometer scale Pd platelets that have a thickness of about 1 nm to about 200 nm and a face dimension of about 10 nm to about 1000 nm, an aspect ratio (face diameter divided by thickness) of the nanometer scale platelets ranges from about 10 nm to about 100 nm.

22. A method of preparing a hydrogen storage material, comprising the steps of:

mixing $C_{10}H_8$, $MgCl_2$, Li and THF with rapid stirring to form Mg;

removing the THF and dissolved by-products to recover Mg nanoparticles;

mixing the Mg nanoparticles with $C_{10}H_8$, Li and THF and with and with palladium chloride, palladium nitrite or cobalt chloride, to coat the Mg nanoparticles with palladium, cobalt and/or an alloy containing palladium or cobalt to form at least one shell or coating over the Mg nanoparticles.

23. The method of claim 22 wherein the palladium, cobalt or an alloy containing palladium or cobalt, is palladium and the shell or coating is a first shell or coating of MgPd, over which is a second shell or coating of Pd.